S7P29.WP

QUALITY OF PIGMEAT AND AGED CURED HAM

M.SEVERINI[1], M.TREVISANI[1], A.R.LOSCHI[2], A.VIZZANI[1] and S.GIGLI[3]

[1] Institute for Science and Hygiene of Food of Animal Origin, Faculty Veterinary Medicine, Perugia, Italy
[2] Institute of Animal Autopsy, Faculty Veterinary Medicine, Perugia, Italy
[3] National Institute for Animal Production, Roma, Italy

INTRODUCTION

The quality of raw pigmeat is of utmost importance in processing aged cured hams (Severini *et al.*, 1983). This aspect should also be taken into consideration in grading pig carcasses (Zedda, 1991). The Italian pigmeat industry and pig producers are very interested in this topic. The results presented in this paper are part of a more extensive research which has been carried out by our group together with a large number of Italian researchers co-ordinated by a National Committee (Chizzolini, 1991; Gigli, 1991; Olivieri and Viano, 1991; Severini *et al.*, 1992).

This experiment was aimed at evaluating whether differences which affect the quality of aged cured hams do exist in the quality of meat from pigs of the same genotype. On this occasion, Goland hybrid pigs were chosen because they are largely used in Central Italy for processing aged hams.

MATERIALS AND METHODS

Animals

50 Goland heavy pigs from the same farm were used in this experiment. Twenty-three animals (group 1) were commercially slaughtered in June 1991 and another twenty-seven (group 2) were slaughtered in December 1991 at the same industrial abattoir.

Fresh meat

Right hind legs were isolated from carcasses immediately after slaughter. The pH and surface colour of the *biceps femoris* (BF) muscle were measured at the side of cutting, at about 45 minutes post-mortem. Colour was expressed as L* value, C* value and H° value (CIE system).

The measurements were repeated after 24 hours of storing at 2°C on the same muscle after trimming the ham. The BF muscle was chosen to represent the whole ham since it is one of the largest muscles of this joint and can be easily measured for pH and surface colour on the cross section.

A portion of *longissimus dorsi* (LD) muscle between the 5th-6th thoracic and the first lumbar vertebrae was isolated from the right half carcass at 45 minutes after slaughter and stored at 2°C up to 24 hours post-mortem. The pH and surface colour were detected at 45 minutes and 24 hours after slaughter.

Swelling ability and drip loss were also measured in the LD muscle according to standard methods described previously (Severini *et al.*, 1992). Such measurements need a relatively large sample and therefore could not be performed in the

BF muscle since the commercial shape for processing the hams was to be kept.

Aged cured ham

Fresh hams were shaped like "Parma ham", dry cured and aged up to 12 months at the same industrial processing plant located in Central Italy. The weight loss after processing was calculated on the basis of the weight recorded after trimming and then at the end of the ageing period and was expressed as percentage of the initial weight. A sensorial evaluation was performed by a group of experts on all hams at the end of the ageing period.

Eight aged hams of each group were selected to represent the whole group. They were cut widthwise at ten centimetres below the head of femoris and evaluated for flavour and taste. Surface colour and pH were measured in the BF and *semimembranosus* (SM) muscles. Samples taken at this level from both BF and SM muscles were used to determine percentage of moisture, protein, fat, ash and NaCl.

RESULTS AND DISCUSSION

Biceps femoris and *longissimus dorsi* muscles were classified according to pH and colour values at 45 minutes and 24 hours after slaughter. Muscles with a pH lower than 5.8 at 45 minutes after slaughter were classified PSE, those with a pH between 6.2 and 5.8 at 45 minutes were classified slightly-PSE and muscles with a pH higher than 6.0 at 24 hours were classified DFD.

Ten of twenty-three carcasses in group 1 and ten of twenty-seven carcasses in group 2 showed similar characteristics in both BF and LD muscles (Table 1). The distribution of carcasses with normal, PSE and DFD conditions was very similar between the two groups. The severe DFD condition was detected only in one case in each group. The PSE, though not extreme, was present in one case in the second group.

The distribution of Bf muscles alone is reported in Table 2 according to the various classes of pH. A balanced distribution between the two groups is also evident. A special condition (PSE/DFD) was detected in one BF muscle in the second group characterised by a slightly low pH at 45 minutes (6.09) and a relatively high pH at 24 hours (6.14). The LD muscle from the same carcass was PSE, therefore it is thought that the animal was stressed but the glycogen content in the BF muscle before slaughtering was low.

LD muscles in the first group, however classified, showed higher values of swelling ability and drip loss than those in the second group (Table 3). The differences between the two groups were much higher than those recorded among the various classes in each group. The effect of breeding factors and/or genetic variability (such as NN and Nn genothypes) in these hybrid pigs has been suggested in a previous study (Severini *et al.*, 1992).

All hams showed good characteristics at the end of the ageing period, but those of the first group had a slightly higher average quality. This was confirmed by the better taste detected in the eight hams selected from this group.

The average weight loss of aged hams in the first group (28.14±2.02%) was lower than that in the second group (31.83±2.07%). All processing factors were standardized and strictly controlled and therefore should not have been responsible for such a difference.

Tables 1 and 2 show no significant differences in weight loss in the aged cured hams processed from carcasses without a severe DFD or PSE condition in both BF and LD muscles in comparison with hams from carcasses with normal muscles. A lower weight loss was detected in the hams from carcasses with DFD muscles and a higher weight loss in the ham from the carcass with PSE muscles. A very high weight loss was also showed by the ham from the carcass with PSE/DFD BF muscle and PSE LD muscle (Table 2).

The results of analyses carried out in BF and SM muscles of the selected aged hams are reported in Table 4. As expected, the average moisture in BF muscles was higher than in SM muscles whereas the opposite occurred for protein content in both groups 1 and 2. This is related to the fact that the BF muscle was left covered in fat and skin, while the SM muscle was largely trimmed of both, according to commercial processing methods.

The hams in the first group showed a slightly higher pH in BF muscles and a higher content of intramuscular fat in both BF and SM muscles than those in the second group. A slightly higher NaCl content was also shown in the hams in the first group.

CONCLUSION

The two groups of Goland heavy pigs slaughtered for processing hams showed a similar distribution of cases of normal, PSE and DFD condition in BF and LD muscles. However, significant differences in the swelling ability and drip loss of LD muscles between the groups were detected. Fresh LD muscles in the first group had a higher swelling ability and drip loss than those in the second group. On the contrary, the weight loss of the aged hams was significantly lower and the content of NaCl slightly higher in group 1. Aged hams in the first group showed also a higher content of intramuscular fat.

It can be concluded that the pigs in the two groups showed differences in some traits of fresh meat, namely swelling ability and drip loss of LD muscles, even though all of them were Goland hybrids. Therefore, breeding factors and to a certain extent genetic variability would appear to greatly affect the quality of meat in these hybrids.

A correlation between the traits of fresh meat as detected in LD muscles and weight loss of aged hams would seem feasible, since differences in weight loss were also observed between the aged hams from the two groups.

The weight loss in aged hams could be related to the swelling ability of fresh LD muscle, because the aged hams with lower weight loss belonged to the group with a better swelling ability in the raw meat and vice versa. The question of whether LD muscle can be considered indicative of the characteristics of the fresh ham is debatable.

Not easy to explains the correlation observed between the drip loss of LD muscles and the weight loss of aged hams, since in this case the lower weight loss in aged hams seems to be in contrast with the higher drip loss detected in fresh meat and vice versa.

However, it should be noted that the drip loss was measured during the first 24 hours post-mortem, but the weight loss of aged hams was evaluated at 24 hours after slaughter onwards.

Nevertheless, the results show that the weight loss of aged cured hams was related to the water holding capacity in fresh meat.
On the other hand, in order to predict the quality of aged ham the sole measurements of pH and colour in LD and BF muscles are not suffice especially in carcasses of non-stressed pigs. Indeed, the DFD condition and the PSE condition of fresh meat seem to weakly decrease and increase the weight loss of aged hams respectively.
Therefore, the water holding capacity of raw meat appears to be one of the most important characteristics in defining the quality of fresh meat for processing hams.

ACKNOWLEDGEMENTS

The present research was supported by the Italian Ministry of Agriculture.

REFERENCES

CHIZZOLINI, R. 1991. Caratteristiche sensoriali di qualità della carne suina e valutazione strumentale. *Riv. Suinicoltura.* 32(9):39-42.

GIGLI, S. 1991. Classificazione delle carcasse suine (metodi complementari al tenore in carne magra). *Riv. Suinicoltura.* 32(9):35-36.

OLIVIERI, E., and VIANO, G. 1991. Applicabilità della tecnica V.I.A. alla caratterizzazione della qualità della carne. *Riv. Suinicoltura.* 32(9):51-56.

SEVERINI, M., DI ANTONIO, E., VIZZANI, A., CENCI, G., and AVELLINI, P. 1983. Correlazione tra qualità della carne fresca di suino e caratteristiche di prosciutti salati e stagionati. *Proc. 29th European Congress of Meat Researcher Workers.* 1:164-171.

SEVERINI, M., TREVISANI, M., LOSCHI, A.R., and VIZZANI, A. 1992. A trial to define factors affecting pigmeat quality. *Proc. 38th ICMST.* Clermont-Ferrand, France. 5:967-970.

ZEDDA, G. 1991. Qualità delle carni. Problematiche relative alla valutazione strumentale. *Riv. Suinicoltura.* 32(9):19-22.

Table 1. Characteristics of carcasses (BF + LD muscles) compared with the weight loss of aged cured hams (means±SD).

Carcasses with BF muscle	LD muscle	Group 1 # cases	L*24h BF	L*24h LD	Wt loss, ham %
DFD	DFD	1	38.86	49.32	27.13
N	N	7	45.37 ± 3.91	52.15 ± 5.24	28.28 ± 1.38
S-PSE	S-PSE	2	47.80 ±10.92	56.30 ± 2.50	27.28 ± 0.49
PSE	PSE	--	--	--	--
Carcasses with BF muscle	LD muscle	Group 2 # cases	L*24h BF	L*24h LD	Wt loss, ham %
DFD	DFD	1	39.17	50.86	29.91
N	N	5	45.49 ± 3.49	52.72 ± 3.63	31.72 ± 1.36
S-PSE	S-PSE	3	47.80 ± 1.49	55.15 ± 1.17	30.67 ± 0.83
PSE	PSE	1	46.03	58.22	32.37

Table 2. Characteristics of BF muscles compared with weight loss of aged cured hams (means±SD).

BF muscle	Group 1 # cases	L*24h	C*24h	H°24h	Wt loss ham, %
DFD[a]	1	38.36	15.97	0.94	27.13
DFD[b]	5	45.61 ± 1.34	10.93 ± 1.16	1.11 ± 0.04	29.39 ± 1.21
N	12	45.90 ± 5.39	13.30 ± 2.20	1.08 ± 0.09	27.78 ± 1.46
S-PSE	5	46.28 ± 8.09	16.23 ± 3.25	1.06 ± 0.08	27.95 ± 3.69
PSE[a]	--	--	--	--	--
PSE/DFD	--	--	--	--	--

BF muscle	Group 2 # cases	L*24h	C*24h	H°24h	Wt loss ham, %
DFD[a]	1	39.17	9.21	1.20	29.91
DFD[b]	9	42.38 ± 2.87	11.93 ± 2.11	1.19 ± 0.06	31.82 ± 2.92
N	10	44.29 ± 3.72	12.89 ± 1.97	1.14 ± 0.11	31.98 ± 1.47
S-PSE	5	47.86 ± 2.48	13.09 ± 2.51	1.12 ± 0.07	31.12 ± 0.91
PSE[a]	1	46.03	13.08	1.24	32.37
PSE/DFD	1	38.49	11.75	1.18	35.47

[a] = belonging to a carcass where the LD muscle showed the same condition.
[b] = LD muscle of these carcasses showed normal characteristics.

Table 3. Drip loss and swelling ability of LD muscles (mean±SD).

	Group 1 N	Drip loss	Swelling ability	Group 2 N	Drip loss	Swelling ability
DFD	1	2.40	36.39	1	0.80	23.45
N	15	1.55 ±0.48	28.91 ± 4.24	12	0.84 ±0.18	16.46 ± 3.74
S-PSE	7	1.89 ±0.89	27.32 ± 2.76	12	0.92 ±0.28	17.52 ± 2.87
PSE	0	--	--	2	1.34 ±0.05	21.98 ± 3.11

Table 4. Characteristics of BF and SM muscle of aged cured hamsn (mean±SD).

	Group 1 BF muscle	SM muscle	Group 2 BF muscle	SM muscle
pH	6.11±0.19	ND	5.91±0.07	5.86±0.09
L8	40.72±3.57	33.84±2.53	41.86±2.10	31.81±1.92
C8	12.89±1.03	11.42±2.46	14.92±1.38	10.81±2.24
H°	1.34±0.07	1.16±0.11	1.18±0.06	1.26±0.07
Moisture (%)	56.29±2.72	41.23±2.33	55.03±1.24	45.63±2.50
Protein (%)	28.61±1.23	40.12±5.00	27.05±1.80	40.98±6.07
Fat (%)	3.11±0.13	4.20±1.44	1.40±0.36	1.96±1.24
Ash (%)	6.40±0.72	8.72±0.76	6.86±0.63	7.77±0.79
NaCl (%)	5.17±0.83	7.21±0.72	4.99±0.99	6.62±0.86